



Innovation and Export Dynamics in the Argentine Soybean Production Chain: a Study in Micro-Macro Interactions

Ramiro Albrieu¹
Gonzalo Bernat²

I. Introduction

It is difficult to find a field of macroeconomics in which experts can disregard Argentina. Researchers that focus on economic growth have compared Argentina with Japan or Australia, concluding that the former had experienced many “lost opportunities”. Researchers that focus on inflation dynamics try to explain how an economy can go from hyperinflation to deflation in just a few years. Researchers exploring international finance and emerging economies wonder whether Argentina played a Ponzi game with its external debt during the late 1990s. Researchers studying business cycles have tried to understand the determinants of excess aggregate volatility and the occurrence of crises episodes. And on it goes.

As we can see, the set of “macroeconomic facts” for Argentina has few positive elements. Albrieu and Fanelli (2008) and Chisari et al. (2008) elaborated growth diagnostics for Argentina in line with Hausmann et al. (2005) methodology, and they detected that the main binding constraint on economic growth is the low appropriability of the returns on economic activity. The idea is simple. Imagine an economy that is subject to external (and policy-induced) shocks and an especially low ability to process them without generating important economic costs and, in some cases, dramatic regime switching. Given this context, investment decisions in physical capital and innovative activities are rather defensive. So, the investment rate is low, especially in those areas where profits are more uncertain, such as Research and Development (R&D). As a result, the average productivity level of the economy is lower than that reported in the developed world. From a macroeconomic perspective, the stylized fact that arises is a divergence in long run growth (cf. Pritchett, 1997).

Nevertheless, since the mid-1990s one sector of the economy has gone in the opposite direction. We refer to the Soybean Production Chain (SPC). Between 1996 and 2007, the primary production of oilseeds grew from 12 million tons to 48 million, whereas SPC exports increased from 11 million tons to 46 million. Hence, Argentina was transformed into the leading exporter of oilseeds and soybean flour, together with being the main worldwide pool of oilseed production in the environs of Rosario, Santa Fe. In sum, SPC registers high rates of growth, is fully integrated with international markets,

¹ Center for the Study of State and Society, CEDES –Argentina. E-mail: ralbrieu@cedes.org.

² CREAR Foundation - Argentina. E-mail: gbernat@fundacioncrear.org.ar.

displays a differentiated pattern of innovative activities, and has developed a complex structure of contracts that it is very difficult to see in the rest of the economy.

In this paper we take neither a purely macroeconomic nor a purely microeconomic approach, but a mix of the two. More precisely, we consider that a decentralized decision of the economic unit regarding investment and technological change (that is, the microeconomics) is determined simultaneously with the characteristics and the performance of the aggregate economy (the macroeconomics). To this end we need to detect whether causation runs in both directions: (a) from macroeconomics to microeconomics, we will take into account that macroeconomic shocks are decisive to defining the (micro)economic structure; (b) from microeconomics to macroeconomics, we will analyze how the economic structure and the institutional arrangements implemented (such as, contingent contracts) affect the ability of the economy to process shocks, taking advantage of the positive ones and filtering out the negative ones.

The present study on the interactions between the microeconomy and the macroeconomy recognizes – and is inspired by – several studies on economic development in Argentina. In particular, the studies of Fanelli and Frenkel (1994 and 2000), Katz (1996) and Kosacoff (2008) have conducted exercises that are similar in spirit to ours. By contrast, the most important difference between these papers and ours is the sector of the economy chosen to represent “the microeconomy”: while we study a branch of the agricultural sector, they analyze the dynamics of the industrial sector. The difference is important because of the diverging paths these two sectors take. In the above papers the authors explained how the uncertain macroeconomic environment makes profitable a specific kind of adaptive behavior that generates a premium on the more flexible or reversible options. Simultaneously, this (directly unobservable) defensive behavior has its observable counterpart in a pattern of low investment in physical capital and R&D, with the corresponding negative effects on economic growth. As we wrote above, this is not the case for the SPC. Therefore, we have to determine new linkages between microeconomics and macroeconomics.

The work is organized as follows. Section II studies the changes in the environment (or the “macroeconomics”) of the individual agent that is part of the SPC and makes decisions regarding investment and innovation. We will see the role played by world markets as well as economic policies. That is, we will study how the aggregative conditions influence the individual decision and in so doing, influence the configuration of the economic structure. Section III describes the microeconomic decisions taken by these agents. We will explain SPC’s strategies for investment in innovation as the (best) response to the perceived changes in the environment detected in Section II. Section IV studies how the resulting economic structure of those microeconomic, decentralized decisions affects the macroeconomic performance. Finally, Section V concludes.

II. Macroeconomic Shocks: External Prices, Exchange rate regimes and Economic Policy Reform

The environment in which the decentralized agent that is part of the SPC takes decisions regarding investment has several dimensions. In our simplified scheme this environment is delimited by two sets factors: (a) international markets and (b) Domestic policies and

government regulations. In this section we will concentrate on the changes that both set of factors suffered in the last fifteen years. The goal of this section is to detect the changes in the different factors of the “SPC environment”, and then see the role that they play in the investment and innovation dynamics of the sector.

Regarding macroeconomic shocks, last the fifteen / twenty years were signed by four big topics. The first one is the evolution of the real exchange rate. In the 1990s the real exchange rate were appreciated, while in the 2003/2007 period it were depreciated. The second topic is the trade policy, that had its swings. In the early 1990s Argentina started a deep process of economic reform, in which one of the central topics was the trade liberalization. After the collapse of the convertibility regime, the taxes on the foreign trade returned -in particular those imposed to agricultural exports. The third topic has to do with the world markets. As we will see, the volatility of prices for SPC products was not negligible. Last but not least was the signing of the Treaty of Asuncion for the creation of the Common Market of the South (MERCOSUR), which had important effects in the strategy of integration to international markets. We will examine each of these factors next.

We begin with the domestic policies. Favorable international prices or a state of high demand can raise the marginal yield to invest in the sector, although this incentive can be offset by domestic economic policies oriented to favor other sectors of the economy or by domestic regulations with the objective of socializing the profits. Schematically, these policies can be of three types: policies regarding the real exchange rate, trade policies that impose taxes on external trade and the legal dispositions related to the transference of technology. Leaving aside the last one, we analyze what happened with the other two.

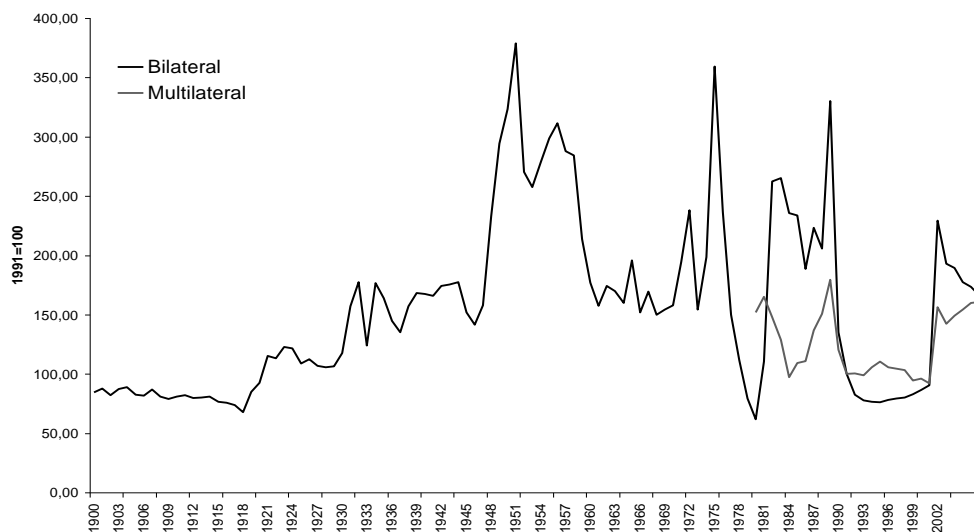
The level of real exchange rate affects positively the transable sector of the economy. On the one hand, maintaining it at competitive levels imply a high relative prices for the tradable sector, and by this means high exports. *Ceteris paribus*, the higher the level of real exchange rate the marginal yield to investment in the SPC sector. However, this incentive can be seen compensated by rises in costs if the sector is intensive in imported inputs or machinery. Additionally, profits can be reduced when the real exchange rate raises if we take into account that there is a negative relationship between the level of real exchange rate and an equilibrium level of productivity. Summing up, the real exchange rate affects in diverse ways the profits in SPC sector. On this, we will suppose that the positive effects are higher than the negative effects.

The following figure sample the evolution of the bilateral real exchange rate with the United States in a long run view (deflating by consumer prices) along with the evolution of multilateral real exchange rate over the last 25 years. If we focused in the last fifteen years, it is interesting to note that in the nineties the appreciated real exchange rate affects negatively the profits in the agricultural sector, in as much it was located at historically low levels. In the 2000s, the end of the convertibility regime produced a jump in the real exchange rate. With variable costs (mainly wages) kept relatively constant, the higher exchange rate generated a higher marginal yield to investment in the agricultural sector (cf. Albrieu et al., 2006). The figure also displays the evolution of the multilateral real exchange rate. From this perspective the real exchange rate (and therefore of the incentives to agricultural investment) was not as volatile as in the bilateral case: neither so high during the 1980s, nor so low in first half of the 1990s.

Regarding the 2000s, note that the overshooting that followed the collapse of the convertibility regime was smoothed and than the competitiveness (as in the bilateral measure) has increased.

Thus, the real exchange rate affects negatively the competitiveness of the agriculture sector and thereby its incentives to invest and innovate. In the 2000s the situation is more favorable as we can see both in the bilateral and the multilateral measures of the real exchange rate.

Figure 1. Real Exchange Rates in Argentina: a Long Run View



Source: INDEC

Now we will refer to trade policy. Trade policy has been at the center of stage in the debates regarding economic development in Argentina since 1880. Several factors motivated this. First, the imposition of tariffs on exports represented one of the main mechanisms of public appropriation of the resources generated by the transable sector. Secondly, one of the main problems of Argentina is that the basket of basic consumption and the exportable production tend to be highly correlated. Therefore, the establishment of a system of multiple exchange rates, e.g. a low effective exchange rate for the exportable sector, operated as a way to control the prices of the basic basket. Thirdly, all along the XX century the productive sectors associated with the industry - typically net demanders of foreign currency -were frequently protected through the impositions and taxes on imports.

The nineties were characterized by a deep process of trade liberalization. In the year 1990 the burdens to exports reached to 25% of the FOB value for soybean grains and of 17% of the FOB value for oil and its byproducts. This tax burden was reduced progressively and, in 1993, grains paid 3.5% of FOB value, whereas the manufactures based on soybean received reimbursements of 2.5% of FOB value. Other taxes were eliminated, including the rate of statistic (3% of FOB value) and the contribution to the INTA (1.5%) and other tie taxes with the external sales. In addition, the commercialization of primary goods was deregulated by dismantling of the Junta de

Granos. In the facts, these institutional reforms allowed the producers of the SPC to take control of a portion superior of their invoicing. Last but not least, the process of trade liberalization determined the reduction of the tariffs for the import of agrochemicals (from 15% to 0%), of fertilizers (from 35% to 0%) and of machinery (from 50% to 15%). Consequently, production costs decreased considerably for the SPC sector.

It is interesting to emphasize two characteristics of how the process of trade liberalization and institutional change affected the SPC sector. On the one hand, the tax structure was preserved in a way to stimulate the industrialization of the harvest, since the tax differential between primary and secondary stages became stabilized about 3% in mid-nineties. The goal of this policy consisted of replicate the tax structure of the main world-wide consumers, who did not apply tariffs to imports from the SPC primary sector, but they burdened the imports of oils and its derivatives.

On the other hand, the challenge that this combination of policies raised for the SPC differed markedly from the situation that had to face a great part of the remaining industrial sectors. The reduction of the taxes on exports and the deregulation of markets increased profits in SPC, stimulating the achievement of innovative investments that allowed it to increase extraordinarily the production as well as the external sales. On the contrary, the opening process implied a diminution of profits (at least in the short term) for the remaining manufacturing branches that were far away from the international state of the art. For them, trade liberalization meant deflation in prices and profits and the reduction in market-share of domestic demand. Then, these enterprises had to invest in innovation in order to be able to dispute domestic markets with competitive imports and, that way, to recover (partial or completely) their profits.

This situation changed substantially by the process of re-regulation initiated when the convertibility regime collapsed. The main trade policy reform had to do with the return of taxes on exports. More specifically, the SPC effective exchange rate changed in a way to transfer resources to the government. The tax reform was initiated on March 5 of 2002 with the decree 11/02 of the ministry of economy that fixed a rate of 10% of FOB price for the oilseeds destined to harvest, 13.5% for seeds with another destiny, and 5% of the FOB price for oils and byproducts. Subsequently new, high rates were imposed, living the tax burden at levels up to 30% for the case of oils and by-products and the oilseeds without harvest destiny.

Some governmental dispositions (as the implementation of subsidies to oil diesel used in the harvest and the transport of the harvest or as the freezing of the energetic tariffs) partially compensated the adverse effect of this new burden on the SPC sector. Nevertheless, with a pattern of increasing costs due to the domestic inflation, this high level of taxes on the agriculture exports was located in center of a big political crisis that lasted four months. It started when the government wanted to restore a regime of variable retentions that implied a (new) raise in taxes for the sector. The farmers started a wide strike that paralyzed exports and produced more inflation. Finally, the administration had to get back and eliminate the proposal.

Table 1. Taxes on Exports in Argentina

Resolution	Begin	Grains		Oil			Byproducts	
		for harvest	not for harvest	Refined (big quantities)	Refined (less than 5 kg)	Crude	pellets and others	Expellers
MEI 11/02	05/03/2002	10	13,5	5	5	5	5	5
MEI 35/02	06/04/2002	20	23,5	20	20	20	20	
MEyP 616/05	11/11/2005							
MEyP 10/07	12/01/2007		27,5	24	24	24	24	9
MEyP 368/07	12/11/2007						32	
MEyP 369/07	12/11/2007		35	32	32	32		

Another factor that strongly affected the incentives to invest in the SPC sector has to do with international prices. The agricultural activity in Argentina composes a good part of the exportable sector of the economy. Therefore, the evolution of prices faced by the microeconomic agent is closely related to the evolution of international (commodity) prices. On the one hand, the unit value of the goods that he or she sells will be associated to the commercialized unit value in the international markets through a condition of purchasing parity (absolute or relative). In that sense, the greater the international price, the greater the profit of the individual producer, *ceteris paribus* taxes and domestic regulations, and taking into account that changes in his/her sales price leaving its costs relatively invariant (in as much it have a nontransable component, i.e. wages). On the other hand, since for the Argentine case it is not right to consider itself as a country a “small producer” in SPC markets, the evolution of world demand matters. The bigger the world market, *ceteris paribus* the protectionist regulations, the higher the mass of profits available for the individual producer.

The following figure shows evidence regarding the temporal evolution of international prices for grains, oils and pellets of soybean for period 1991-2008. Note that, in broad lines, we can distinguish three stages. The first stage goes from 1991 to 1996/97, time in which the prices grew strongly: 60% for oils, 30% for grains and 50% for pellets. The second stage goes from 1997/98 to 2002. During this stage the prices collapsed: 55% for grains and 40% for oils and pellets. As a general rule, the prices returned to the pre-nineties levels. Finally, the third stage goes from 2002 until the present time. During this stage we can see an explosive dynamics for the SPC sale prices. The price of grains raised a 129% if we compare the year 2002 with the year 2007. In the same period the prices of oils raised 164% and the price of pellets 120%. As a consequence, it is in this last stage when the most positive price incentives for the sector arise.

Figure 2. Evolution of prices of the SPC



Source: CIARA

Finally, it remains to comment the effects on the sector of the creation of the Mercosur. The following figure sums up all the relevant information. Note the following. In the year 1991 of the totality of the Argentine exports to the world, practically 70% were related to the agricultural activity: 41% from manufactures and 27% from primary products. 15 years later, the shares of these activities in total exports fell, getting to represent a 51% for year 2006. Two effects generated this change. The first one is related to the evolution of fuel prices that has been rising dramatically over the last ten years, well above the prices of other components of the export basis. The second one has to do with the phenomenal increase of the volume of exports of the manufactures of industrial origin. In 1991 it represented 25% of total exports, while in 2006 it increase its share up to 31%, without significant changes in its price.

If we analyze the figures more carefully we can figure out what had happened. More precisely, we can fully understand this change by checking the evolution of the exports to MERCOSUR countries. Note there that the external sales to the region have grown more than proportionally in the sectors in which Argentina does not have comparative advantages: the industry. In fact, the exports of products associated to agriculture to the region reduced its share to a half from the creation of the treaty, constituting this way a market of smaller importance for the SPC relative to the rest of the world. The Mercosur has been useful then to diversify the exporting base, but it has not had very strong effects on the SPC activity.

Table 2. Export Dynamics

	Related to Agriculture			Industrial Manufactures	Energía
	Primary products	manufactures	Total		
To the world					
1991	27,18	40,80	67,97	24,56	7,46
1996	24,19	35,33	59,52	26,89	13,59
2002	20,55	31,73	52,28	29,63	18,08
2006	18,57	32,81	51,38	31,91	16,70
To MERCOSUR					
1991	31,48	20,35	51,83	40,32	7,85
1996	19,44	16,72	36,16	44,27	19,57
2002	17,12	12,88	30,00	49,00	21,01
2006	14,79	10,89	25,68	57,11	17,21
Difference (world - MERCOSUR)					
1991	4,30	-20,44	-16,14	15,76	0,39
1996	-4,76	-18,61	-23,36	17,38	5,98
2002	-3,43	-18,85	-22,28	19,36	2,92
2006	-3,78	-21,92	-25,70	25,20	0,50

Source: CEI

III. Micro responses to macro shocks: innovation and productivity

III.1. Innovation and productivity in the nineties:

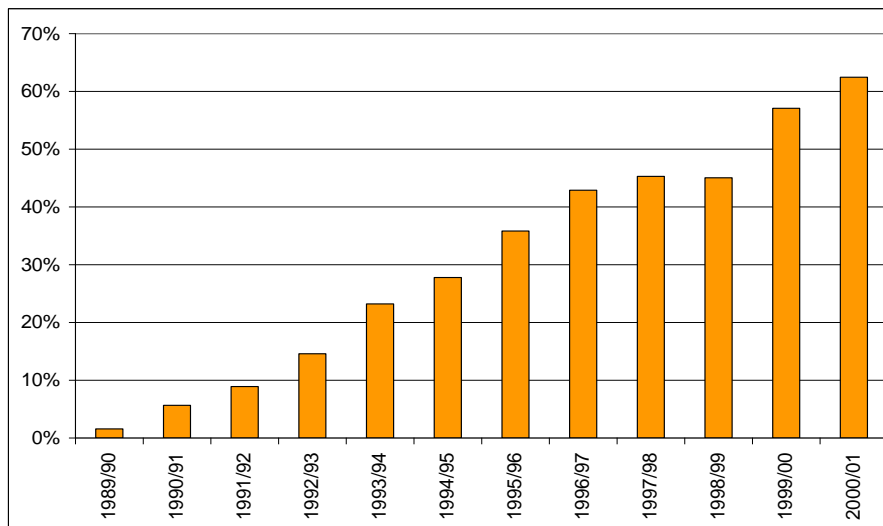
- *Innovative dynamics:*

Regarding soybean cultivation, the predominant productive model during the eighties (based on the restricted use of control biocides, fertilizers and mechanization) was altered radically throughout the nineties, as a consequence of two successive phases of innovative investments: 1) 1991-1996, characterized both by the diffusion of the direct sowing technique and by the delayed insertion of local farmers in the “green revolution” (that included the intensification of the usage of fertilizers, agro-chemicals and machinery); 2) 1997-2001, associated to the incorporation of GMOs (Genetically Modified Organisms), the increase in the incidence of direct sowing technique and the rise of fertilizers’, agro-chemicals’ and machinery’s utilization.

During the first stage, innovation was encouraged by the increase of producer’s profit margins, which was both a result of the institutional transformations described previously and of soybean complex’s international prices’ growth. Simultaneously, the

cost of adoption of the system of direct sowing and of the “green revolution” was cheapened substantially by the reduction of tariffs for the import of agrochemicals, fertilizers and machinery. Consequently, during this period, the percentage of surface worked with soybean through the direct sowing technique was enlarged radically, as it evolved from 2% in the 1989/1990 campaign to 36% in 1995/1996 (Figure 3), reason for which sowing machines related to this new system, tractors of greater power (between 120 and 180 HP) and fumigation equipment were acquired. In addition, primary producers augmented considerably their usage of fertilizers and agrochemicals, in particular of the “glyphosate” weed killer (associated to the new sowing technology), whose consumption grew from 100 thousand liters in the 1992/1993 campaign to 1,3 millions in 1996/1997.

Figure 3
DIRECT SOWING TECHNIQUE’S INCIDENCE IN SOYBEAN CULTIVATION.
1989-2001.
As a % of total sowed surface:



Source: Based on data from AACREA.

The second innovative phase started with the diffusion of the glyphosate resistant genetically modified soybean seed, in 1996. This innovation was apprehended by local producers with only a slight delay with respect to its introduction in developed nations. The domestic assimilation of this GMO had the purpose of reducing production costs³, in order to compensate against the loss of yields brought about by the fall in soybean’s international prices and therefore, to allow for debt’s payment (that had been contracted with financial organizations and suppliers/clients during the first stage of investments). In that instance, soybean cultivators implemented a “forward exit” (Bisang, 2001) as they innovated in order to restore their profit margins and enable their repayment of contracted debts.

³ The reduction in production costs brought about by the new technology was accentuated due to Monsanto’s impossibility to obtain integral property rights over their invention, as domestic legislation authorized seed reproduction for producers’ own use. Besides, illegal reproduction of GMOs (denominated “white bags”) became extended in this period.

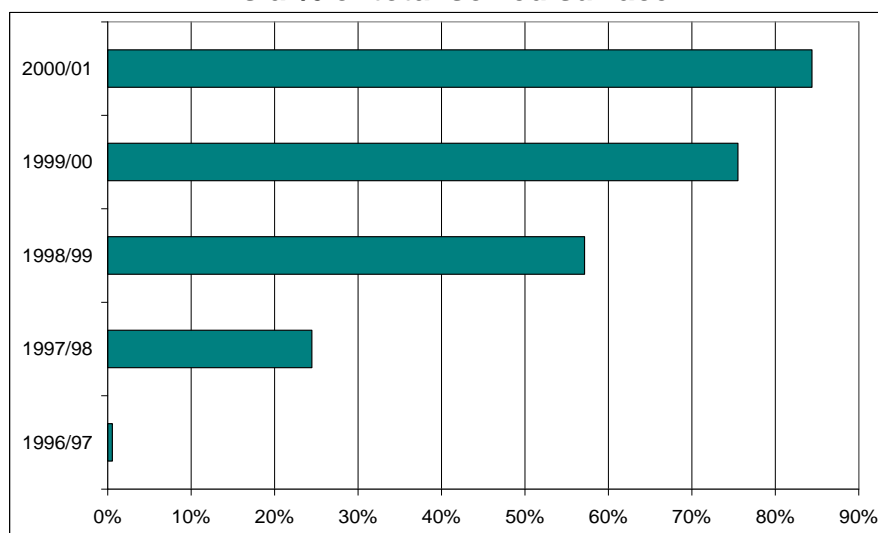
During this phase, two agents had a decisive role in the diffusion of the new technologies within soybean production. On the one side, “Sowing Pools” and “Direct Investment Funds” (DIF) arose with the objective of increasing productive scale without concentrating land ownership (which is significantly atomized in Argentina). Sowing Pools are associations in which proprietors rent their lands to farming labors’ administration companies that carry out production with both their own funds and capitals from clients or investors (often external to the primary sector). Direct Investment Funds differ from Sowing Pools mainly due to their strong legal base, that requires the participation of more actors. Anyway, both productive organizations are able to take advantage of scale economies (to cheapen their technology access from input’s and capital goods’ providers, increasing innovative investments’ profit margins) and to diminish climatic and economic risks (by diversifying geographical areas and crops). Besides, due to the presence of highly qualified technical consultants, these agglomerations cumulate the necessary skills to implement technological upgrade.

On the other side, contractors provide machinery and equipment services (e.g. sowing, harvesting and fumigation) for farmers, especially for oilseeds and cereals producers. In this way, the latter are able to avoid elevated innovation costs associated with machinery and equipment investments. Nowadays, contractors harvest more than 60% of total sowed surface. Although these agents appeared in Argentine agriculture in the early 20th century, their relevance spread out during the last lustrum of the nineties, when direct sowing technique (which demanded more powerful, and thus more expensive, machines) and GMOs (that required agrochemical’s and fertilizers’ application’s services and allowed productive frontier’s expansion) became massive. Besides, contractors contributed to alleviate financing restrictions, as they usually provide funding to their clients (including inputs like seeds, agrochemicals and fertilizers).

Also, transgenic varieties were complementary of the direct sowing technique, as it demanded the intensive use of glyphosate and fertilizers. On that matter, diverse studies indicate that the combination between the GMO and direct sowing resulted in a yield’s increase superior to 10% in relation to the previous productive model. In addition, this amalgam allowed for the development of the “double culture system” (usually, wheat in winter and soybean in early summer) and for the expansion of this oilseed towards areas of smaller productivity, like the provinces of Entre Ríos, Santiago del Estero, Salta and Córdoba.

Consequently, the percentage of surface sowed with transgenic soybean, that had been practically null in the 1996/1997 campaign, surpassed 80% in 2000/2001 (Figure 4). Simultaneously, the incidence of direct sowing in this production grew from 43% to 62% in the same period, while the consumption of glyphosate exceeded 8 million liters in the 2000/01 campaign.

Figure 4
GMO's INCIDENCE IN SOYBEAN CULTIVATION. 1996-2001.
As a % of total sowed surface:



Source: Based on data from ASA.

In the meantime, the vegetable oil industry replicated the intense investment process carried out by soybean primary producers, with the aim of taking advantage of the growth of profit margins derived from; the derogation of export duties on vegetal oils and by-products, the deregulation of local markets, the rise in international prices and, particularly, a differential exchange rate regime in respect to beans' exports. Even more, the real exchange rate's appreciation did not reduce significantly this sector's price-competitiveness, as it is not characterized by an intensive usage of non-tradable inputs (like labor).

In contrast with the rest of Argentine manufacturing industry, this sector implemented investments without delay in relation to described global, institutional and macroeconomic transformations, since it is composed by agents of high dimensions and significant international insertion (that, in both cases, allowed the elusion of domestic volatility and local financing restrictions).

It is important to state that, during the nineties, the majority of oil companies' investment was not of innovative nature, as it was based on the expansion of installed capacity and on the construction of new plants and refinement lines⁴, whereas it did not involve substantial improvements in either process or product technologies. However,

⁴ According to CEP (1999), this sector invested us\$850 millions during the nineties: us\$500 millions to acquire existing factories; us\$200 millions for new plants; and us\$150 millions in equipment and amplification of installed capacity. In particular, "green-field" investments were associated to the domestic arrival of subsidiaries of the main global players (ADM, Cargill, Bunge, Louis Dreyfus), which reassigned internationally their milling capacity from developed nations (e.g. United States) towards countries that presented static comparative advantages (e.g. Argentina and Brazil) and/or huge potential markets (e.g. China).

these firms carried out a limited amount of expenditures in innovation in order to integrate “up-stream” and “down-stream”, acquiring and constructing storage centers, railroads and ports. Even, in the last case, new technologies were introduced that increased loading speed.

- *Adaptation and diffusion sources of innovations:*

Regarding adaptation and diffusion sources of innovations, both in oilseed's complex's primary and manufacturing segments, successive jumps in international state-of-the-art were generated exclusively by developed economies' agents. Later, and in each case, domestic producers assimilated (with major or minor rapidity) these innovations by means of the adoption of technology incorporated in facilities and/or machines and/or inputs and through the admission of non-incorporated knowledge originated in the National Innovative System and in private institutions. In contrast, innovative efforts of endogenous nature by primary and secondary producers were scarce, limiting themselves to the implementation of minimum incremental improvements to exogenous flows.

In particular, soybean producers' innovative investment registered a substantial transformation regarding national adaptation and diffusion sources, evolving from a scheme with a preponderant participation of National Innovative System's state organisms (and, to a lesser extent, of diverse non-profit institutions) towards a system with predominance of the subsidiaries of the main international agricultural inputs suppliers, in which Public Sector's role was relegated increasingly to the regulation and homologation of the new technologies.

Besides, since the seventies, the local subsidiaries of the international companies De Smet, Westfalia and Lurqui have acted like the main domestic introducers of the advances in world-wide state-of-the-art within national vegetable oil industry. In fact, this companies launched the chemical extractive technology (process innovation) in the domestic market, which was the last jump in the sectorial knowledge frontier. Therefore, in the period under study, this firms were responsible for the design of new plants and for the provision of equipment and engineering services for the modernization and extension of existing factories.

- *Inputs and machinery:*

During the nineties, successive phases of innovative investment by national soybean producers (delayed adoption of the green revolution and direct sowing and early assimilation of biotechnology) fomented the increase in the use of seeds, fertilizers, agrochemicals and machinery, due to the extension of the agricultural border, the diffusion of the double culture system and the augmentation of inputs per hectare. The continuous expansion of local demand for these articles coexisted with the growth in the concentration of domestic supply and with the gain of participation of imports in the internal market.

On the one hand, the fast adaptation⁵ and diffusion of the glyphosate resistant soybean altered the configuration of the national seeds market, which was previously symmetrically distributed between locally owned companies and foreign firms' subsidiaries. Nevertheless, in the last years of the nineties, the GMOs manufacturing subsidiaries (Pioneer, Nidera, Monsanto and Novartis) increased their participation in the internal supply. Even, they absorbed diverse Argentine companies, with the aim of taking advantage of their domestic developments, their distribution network and their prestigious trademarks (Bisang, 2001).

Contrarily, national companies (of smaller technological capacity) were limited to the manufacture of varieties of specific seeds, designed to adapt to the idiosyncratic needs of local production. In fact, both the macroeconomic volatile domestic context and the financing restriction conspired against the investment in innovation of this segment's SMEs and, consequently, against the preservation of their incidence in local supply. Anyway, firms like Don Mario, Relmó and Tijereta (with Monsanto's license) managed to participate actively in the provision of transgenic soybean, although essentially as a corollary of the inappropriateness of the local application of the Patents Law for this innovation.

Also, the introduction of GMOs resulted in the amalgam between the supplying of seeds and the provision of agrochemicals and fertilizers (largely imported), replicating the tendency registered in developed nations. Consequently, the degree of concentration of both markets was notoriously increased, to the detriment of the national companies' sales⁶. It is important to emphasize that, due to the sharp growth of local demand, domestic elaboration of fertilizers and agrochemicals expanded significantly in the nineties, as a result of investments (mainly by foreign companies) in the construction of plants and the extension of installed capacity.

The unification of these inputs' supply was complemented with the advisory service regarding this technological package's usage. To this end, a regional/national diffusion network was settled down (the "Service Centers"), through which a codified (via inputs) and decoded (via direct advising) knowledge flow circulated, replacing traditional public and private extension systems (Bisang, 2001).

On the other hand, the increase of internal demand for agricultural machinery was taken advantage of fundamentally by domestic producers during the first years of the nineties. Later, imported capital goods (particularly those of Brazilian origin) gained participation in the local market, making difficult the performance of national companies and, in some cases, causing the closure of factories which extensive trajectories in this industrial sector.

Finally, regarding the provision of equipment and implements for Argentine vegetable oil industry, the local subsidiaries of the international companies De Smet, Westfalia and Lurqui monopolized the attention of internal demand, revalidating the tendency observed during the two previous decades. This result was sustained in the high

⁵ Local seed producers adopted foreign products to the multiple local conditions, for which they utilized their R+D departments' capacity.

⁶ In the late nineties, glyphosate sales represented more than half of the herbicide market. Also, both production and import of this input was dominated by the local subsidiary of Monsanto.

technological and commercial capacity of said firms, which allowed them to comfortably bear both the reduction of import tariffs and the loss of price-competitiveness derived from the real exchange rate's appreciation. As well, this companies enhanced their productivity by means of the outsourcing of diverse productive processes in favor of a set of small national factories, to which they stimulated to improve their levels of competitiveness and their times of delivery.

Marginally, the technological supply of these subsidiaries was complemented by the production of a great number of small factories, which provided electronic control systems, scales, dryers, chain dumps and other services. These companies were located near the main manufacturing regional poles and they benefited, in some cases, from a natural protection against imports originated in comparatively lifted transport costs. Therefore, during the nineties, the totality of local agents (including De Smet, Westfalia and Lurqui) supplied near 95% of the vegetable oil industry's machinery and implements needs (Obschatko, 1997).

- *Productivity:*

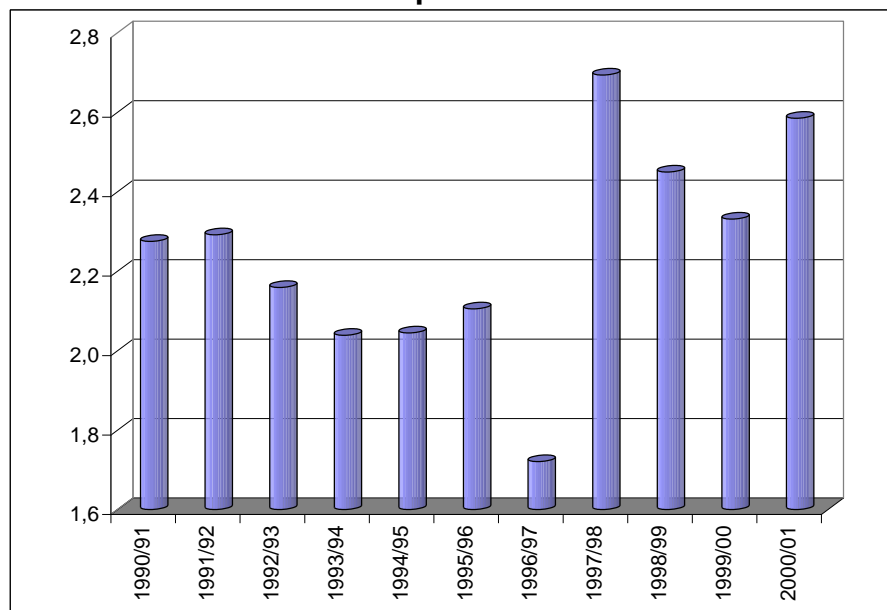
Naturally, during the nineties, the previously mentioned investments caused the growth of soybean complex's productivity, increasing its non-price-competitiveness (which was originally elevated as a result of natural static comparative advantages). In that way, this chain's profit margins were augmented again, after the previous raise that had been motivated by macroeconomic, institutional and international transformations described above. Additionally, this result allowed for the expansion of local complex's participation in external markets, reality that contrasted with the efforts of diverse Argentine manufacturing branches to gain productivity in order to dispute the internal market with imports.

In the case of soybean cultivation, the evolution of productivity was influenced by both innovative stages. Between the 1990/1991 and the 1995/1996 campaigns, the mean efficiency of this oilseed exhibited a slightly decreasing tendency⁷, dynamics that was explained by two opposing forces. On the one hand, the diffusion of the direct sowing technique and the delayed insertion in the "green revolution" determined a productivity raise. On the other hand, the former innovation allowed for the expansion of production towards regions of smaller yields, which established the fall in the mean level of the variable at issue. Consequently, productivity grew substantially in the Pampas Region, although its average descended as a result of soybean's cultivation extension towards fringe areas.

Later, during the second innovative phase, the adoption of transgenic soybean generated an obvious growth in yields, that surpassed 2,5 tons per seeded hectare in 1997/1998 and 2000/2001 campaigns (Figure 6). Again, the increase of the mean level of this indicator was attenuated by a new expansion of production towards zones of inferior productivity.

⁷ The fall registered in the 1996/97 campaign originated in adverse climatic conditions.

Figure 6
SOYBEAN AVERAGE YIELD. 1990-2001.
Tones per hectare:

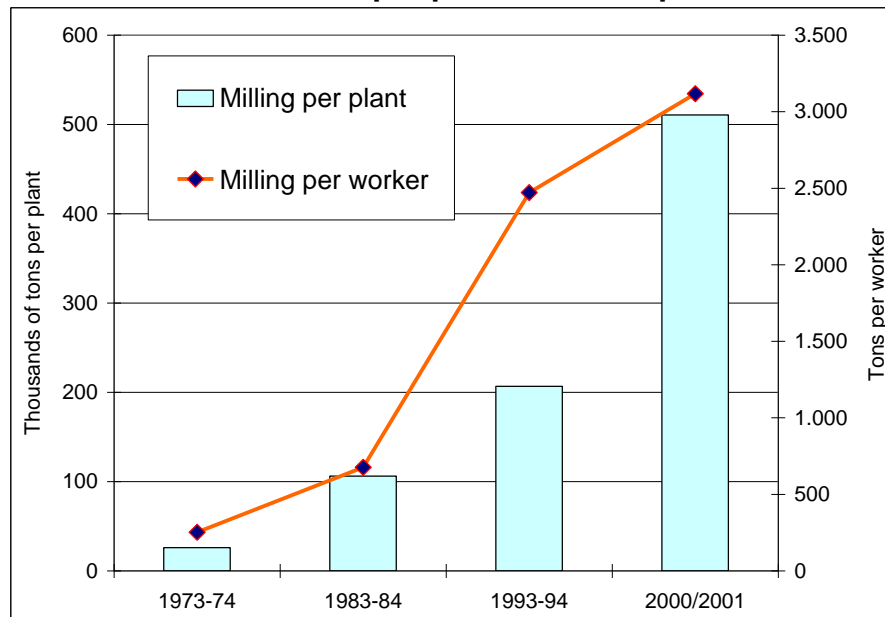


Source: Based on data from the Secretary of Agriculture.

Concerning the industrial segment of this complex, the different productivity measures maintained a tendency of sustained increase, that had begun at the end of the seventies by means of the gradual incorporation of the chemical extraction technology and the systematic construction of factories of major dimensions. On that matter, the number of tons processed by plant augmented from 26 thousands in 1973/1974 to 511 thousands in 2000/2001. Simultaneously, the manufacture of oil and derivatives per worker grew from 252 tons to 3.117 tons in the same lapse⁸ (Figure 7).

⁸ The dynamism of this industrial sector created a growth in direct occupation superior to 50%, in spite of the continuous augmentation of milling plants' size (Obschatko, 1997 y AACREA, 2005).

Figure 7
VEGETABLE OIL INDUSTRY'S PRODUCTIVITY (*). 1974-2001.
Thousands of tons per plant and tons per worker:



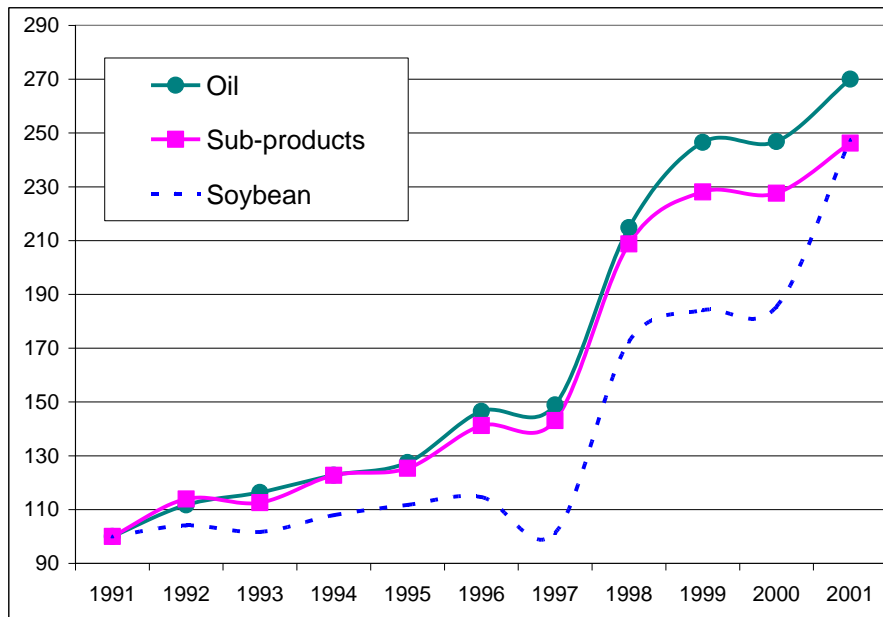
(*) This data belongs to the totality of oil plants, including both those that process soybean and those that process other oilseeds.

Source: Based on data from Obschatko (1997) and AACREA.

Also, the investments implemented by the soybean complex encouraged the continuous increase, in two phases, of this oilseed's harvest and processing levels. Between 1991 and 1996, primary and secondary productions were increased 15% and 40%, respectively. During this lapse, the best comparative performance of the manufacturing segment resided both in the widening of the milling capacity and in the mentioned raise of productivity.

After the adverse climatic effects of 1997 (that forced oil manufacturers to import beans), the complex resumed growth at a superior rate: soybean harvest increased 116% between 1996 and 2001, whereas processing augmented 75% (Figure 8). The dynamics of the primary segment derived from the productivity rise associated to the introduction of GMOs and the expansion of the surface destined to this oilseed, while the industrial segment increased its milling capacity in order to absorb the greater supply of grains.

Figure 8
SOYBEAN'S HARVEST AND PROCESSING. 1991-2001.
Index 1991=100:



Source: Based on data from the Secretary of Agriculture.

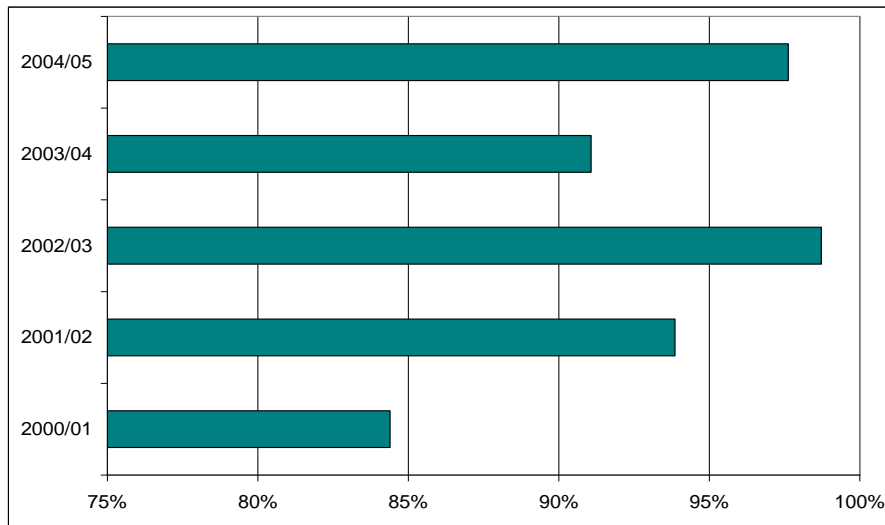
III.2. Innovation and productivity in the new century:

- *Innovative dynamics:*

From 2002 onwards, as was stated in a previous section, institutional and macroeconomic changes implied the raise of this chain's yields. In particular, this increase was more significant for national agents, since they not only received a greater unitary margin in terms of dollars but, additionally, benefited from the growth of its spending power in the domestic market as a corollary of the devaluation of the Argentine currency. In second instance, since 2002, international prices for soybean and its byproducts have continuously augmented, determining systematic enhancements in this complex's earnings.

This utility's increase encouraged the implementation of a new innovative phase in order to expand production and, fundamentally, exports. On the one side, primary producers deepened the second investment wave of the nineties, since GMOs incidence (last advance in the international state-of-the-art) grew, and so did the usage of the direct sowing system, fertilizers, agrochemicals and machinery. The pronouncement of transgenic soybean's use accentuated even more the profit margin's rise, since it allowed for the reduction of production costs. Therefore, the percentage of surface seeded with this genetically modified variety expanded from 84% in the 2000/2001 campaign to 98% in 2002/2003 and 2004/2005 (Figure 9). Simultaneously, due to their complementariness with GMOs' technology, the area cultivated with the direct sowing system and the usage of fertilizers and agrochemicals (in particular, the weed killer glyphosate) also increased.

Figure 9
GMO's INCIDENCE IN SOYBEAN CULTIVATION. 2000-2005.
As a % of total sowed surface:



Source: Based on data from ASA.

The main difference of this investing phase with the preceding one resided in the diffusion of the “silo-bags” storage technology, innovation that allowed farmers to regulate their sales of beans in the short term, protecting themselves against cyclical fluctuations in the internal and foreign markets’ conditions (Bisang, 2007). Even, this system made possible the use of this oilseed as a currency-proxy during the 2002/2003 campaign, promoting working capital self-financing in a context of a notorious credit rationing⁹.

Regarding the vegetable oil industry, it mirrored the innovative dynamics implemented by the primary segment during this period, in order to take advantage of the growth of its yields derived from macroeconomic, institutional and international transformations. As was observed in the nineties, a great part of these investments were of non-innovative order, since they included the extension of installed capacity and the construction of new plants and lines of refinement, although they did not register substantial improvements in the process and product technologies. On that matter, the amount of oil plants expanded from 47 at the end of the nineties to 53 in 2006, finalizing the net mortality process that had begun in the middle seventies and that had mainly been tied to the closing of small factories specialized in sunflower milling by means of the pressing system. In that way, domestic installed capacity grew from 92 thousand daily tons in 1998 to 100 thousands in 2004 and to 132 thousands in 2006, while the new investments that are currently being carried out will lift this value to 160 thousand tons in the short term¹⁰.

⁹ In smaller producers’ case, this financing restriction, that added to the considerable weight of liabilities (financial and commercial) contracted during the previous decade enticed the sale or rent of their lands to contractors, promoting the augmentation of the concentration in the primary segment of the soybean complex.

¹⁰ Nowadays, the average plant size of the national industry is superior to the values of American and Brazilian firms.

Also, the previous evolution was associated to the consolidation of both this industry's concentration and the incidence of the subsidiaries of international companies (Bunge and Born, Cargill, Glencore, Nidera and Louis Dreyfus). In fact, only three big firms of national capitals (General Deheza, Vicentín and Molinos Río de la Plata) are among the leaders of the sector. Finally, vegetable oil producers innovated during this phase by means of the gradual establishment of contractual relationships with their suppliers of beans, with the aim of guaranteeing their greater supplying needs in line with the extension of their installed capacity. These bonds assumed diverse modalities, since in some cases provision of technical and/or financial attendance to farmers were contemplated while, in other occasions, the relation was exclusively commercial (Gutman and Lavarello, 2003).

- *Adaptation and diffusion sources of innovations:*

As was stated previously, the expansion of soybean complex's (in particular) and agriculture's (in general) international state-of-the-art was motorized fundamentally by developed economies' agents. Locally, these innovations of foreign origin were assimilated (with major or minor speed) by national producers through technology incorporated in facilities and/or machines and/or inputs and through the reception of non-incorporated knowledge originated in the National Innovative System and in private institutions. On the contrary, endogenous innovations on behalf of primary and manufacturing producers were habitually scarce, confining themselves to minimum incremental improvements to the flow provided by exogenous actors (local or foreign).

Therefore, during the last lustrum, there were no radical changes in this complex's national sources of adaptation and diffusion of knowledge. On the one hand, concerning soybean producers, the predominance of subsidiaries of the main international suppliers of inputs persisted in the adjustment and dissemination of innovations (GMOs), whereas the role of the Public Sector continued mainly limited to the regulation and the homologation of the new technologies (with the remarkable exception of the efforts of the INTA – National Agricultural Technological Institute- to develop transgenic varieties of some regional cultures).

On the other hand, regarding the oil industry, the local subsidiaries of the international firms De Smet, Westfalia and Lurqui preserved their status as the main domestic diffusers of the last advances in the world-wide state-of-the-art (the system of extraction by chemicals). Therefore, between 2002 and 2006, these companies were responsible for the design of the new constructed plants and for the provision of the majority of the equipment and the engineering services necessary to modernize and to amplify existing factories.

- *Inputs and machinery:*

During the first lustrum of the new century and concerning the primary production, the accentuation of the penetration of transgenic soybean promoted a new increase in the usage of fertilizers, agrochemicals and machinery, the extension of the agricultural border, the diffusion of the double culture and the growth of the use of these inputs per sowed hectare. As well, the sustained enhancement of the local demand for these products was associated to the concentration of the internal supply (mainly, around the Services Centers) and with the gain of participation of imports in the internal market.

In this period, the subsidiaries that manufacture nationally and/or that import (from their parent firms or other branches) the package of inputs utilized by the primary producers, like Pioneer, Nidera, Monsanto and Novartis, increased their participation in the domestic market. More so, the growth in machinery's demand was not associated with a relevant process of imports substitution, as tractors and harvesting equipment of foreign origin continued dominating the supplying of internal demand. As a positive characteristic, the diffusion of silo-bags allowed for a greater incidence of local providers in the attention of the Argentine market.

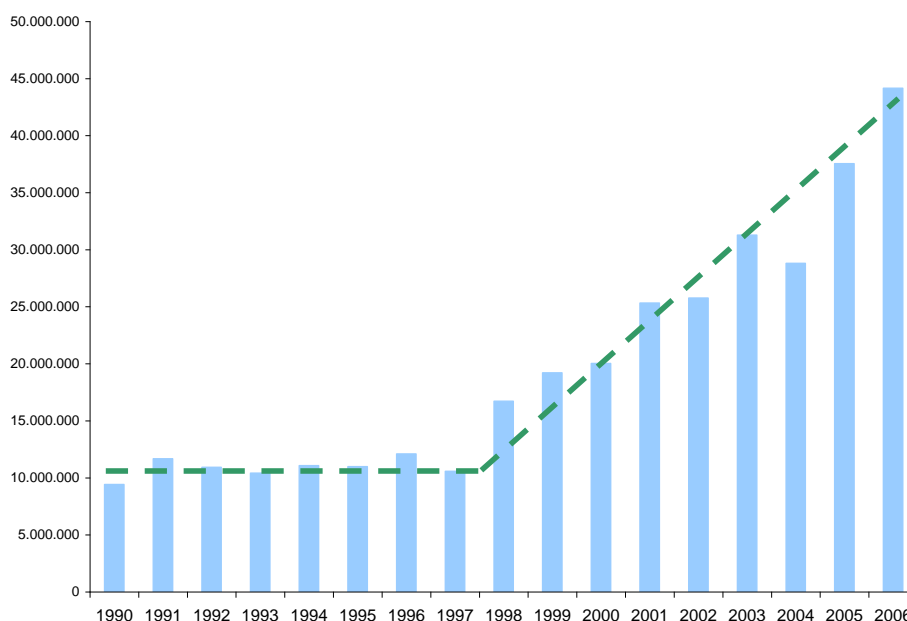
Finally, the provision of equipment for the oil industry was concentrated in the subsidiaries of De Smet, Westfalia and Lurqui and, to a lesser extent, in diverse small factories. This position was sustained in the non-price-competitiveness (based on productivity and technology) which national manufacturers already possessed, which was accentuated by the competitiveness-price gain derived from the depreciation of the real exchange rate.

IV. Macro reactions to micro changes. Sustainability of external and fiscal accounts, and the problem of inflation

The mutations in the microeconomic structure and the governance institutions studied in the previous section had important effects on macroeconomic performance. In the present section we will study in detail this micro-macro interaction.

The first evidence is that, given the close integration of the SPC to international markets, the evolution of its exports replicated the evolution in its production. In 2001, the SPC exported 26 million tons of oilseeds, oils and flours, which meant an increase of 133% with respect to 1991's exports (see figure xxx). The Argentine share in world wide oil vegetal exports increased during this period, from 30% at the beginning of the nineties to 40% in 2001. As can be seen in the following figure, the trend observed in the last decade is radically different from the trend observed in previous years.

Figure 10. Volume of Exports of the SPC



How did it affect the macroeconomic performance of Argentina? We will explore this issue in the rest of the section. We will consider three basic links between this exports dynamics and the macroeconomy: (a) the changes in fiscal sustainability; (b) the changes in external sustainability and (c) the effects in inflation. Of course, the differential evolution of SPC had other consequences, such as the changes in labor demand and the emergence of dualism inside the agricultural sector. Regarding the former, there is no consensus regarding its effects; some authors say they are positive (see Llach et al., 2005; Bisang, 2007) while other say just the opposite (see Rodriguez, 2005). Regarding the later, there is evidence that it is not easy to replicate the high-productivity pattern of the SPC in other branches of the agriculture sector (see Teubal and Giarraca, 2005). In what follows we will let these issues aside and concentrate in the three mentioned above.

The first topic is the effect on the SPC performance on the trade balance of the balance of payments. As it is observed in the following figure, the dollar value of total exports had been duplicated between 2003 and 2007, together with an increase of SPC exports in total exports. In 1997 SPC exports contributed about 10% of total external sales, while one decade later it contributes 24%. The resultant positive effect on exports improves the macroeconomic situation at least in two ways. First, since Díaz Alejandro's (1970) seminal work on Argentine economic history several authors had pointed out that one of the main problems Argentina faces in trying to achieve a high long run growth is the external (balance of payments) constraint. More precisely, potential output cannot be achieved because the exportable sector fails to provide enough dollars to buy the imported machinery and related inputs that are needed. Once the country is growing fast, the trade balance turned negative and the growth process must stop. Nevertheless, in the last five years the economy has expanded at high rates, which more than duplicated its historical average, and the external constraint is far from being operative.

Second, a positive shift in exports growth has another very important role: to reduce the probability of a macroeconomic crisis to happen. A better off situation in the flow of external accounts that shows persistency alleviates external debt problems. It is very important because explosive dynamics for external debt used to be at the center stage in many economic crises not only in Argentina but in the emerging world as a whole. (Fanelli, 2008; IADB, 2007).

It is interesting to examine this latter issue in more detail. Particularly, we want to detect how much of the recent improvement in the external sustainability is related to the performance of the SPC. Therefore, following Corso and Fanelli (2006), we will take a closer look to the problems of the external gap by reproducing frequently used indicators in the literature on sustainability of the external debt. The indicator is based on the interaction between two ratios of external debt over GDP: the "current" or "observed" and the "required" or "needed" to maintain that ratio constant taking into account different scenarios the patterns of economic growth and interest rates. We define d_t as the ratio between net external liabilities and the GDP in period t , r_t is the net rate of interest that the country is paying in period t related to stock of net external liabilities in period $t-1$, g is the long-run rate of economic growth, and tb_t is the observed ratio between the trade balance (goods and services) and the GDP in period t .

The increase of the net external debt/GDP ratio can be expressed as:

$$\Delta d_t = d_{t-1} \left[\frac{(r_t - g_t)}{(1 + g_t)} \right] - tb_t \quad (1)$$

If we equalled Δd_t to zero, is possible to define the “required” trade balance tb_t^* as the one that maintain the net external debt/GDP ratio constant over time, i.e.

$$tb_t^* = d_{t-1} \left[\frac{(r_t - g_t)}{(1 + g_t)} \right] \quad (2)$$

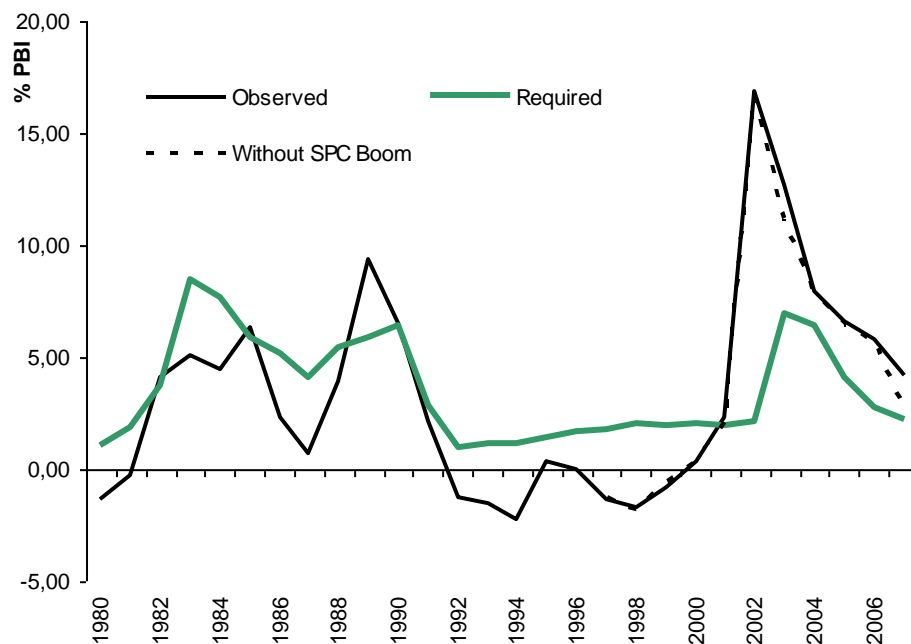
Figure 11 shows the evolution of the observed trade balance (tb) and of the required balance required, calculated according to the expression (2) for period 1970-2007. As it can be observed, in the 1970s- that is, before financial integration took place-the episodes of external fragility were not lasting, in as much the trade balance adjusted very fast. Then, in the eighties, the problems of external vulnerability increased, in a situation in which the tightening of the international financial markets after the Mexican crises imposed huge efforts to an economy that had to manage to generate important trade balance surpluses. A different stage began with the structural reforms of the nineties. In all the period in which the convertibility regime was applied (1991-2001) the effective trade balance was consistently below the required one. Obviously, this indicates that the external debt was growing of high rates. Note, nevertheless, that near 1998, the gap between tb and tb^* began to close, due to the recessive adjustment of the imports. Nevertheless, this effort was not sufficient. Later, after the convertibility collapse the observed trade balance surplus was extremely high, in as much positive effects of prices and quantities fueled the exports while a GDP well below its potential level did not generate a strong demand of imports. With the time, the sustained economic growth reduced the effective trade balance strongly, although the required ratio was also reduced as a result of the renegotiation of public external debt and of the process of re-paying public debts started in 2005.

Now we ask ourselves how much the SPC influenced this change in the external position. To analyze this, the dotted line shows the path of the trade balance that had been observed when we suppose that the SPC sector grew slower in the period 1997-2007. More specifically in this scenario we are supposing that the exports of the SPC sector grew at the same rate the other products of exportables did. That is to say, this scenario supposes a lower innovative activity in the sector as well as less dynamic behavior of its exports. Note the following. Although in a period immediately posterior to the devaluation of 2001/02 no difference is observed, it seems like the present situation of external sustainability does depend on the SPC boom.; As a matter of facts, in the scenario where the boom does not come about, the observed trade balance fell considerably in 2007 so as to be equivalent to that required to assure the external sustainability. To put it in another way, without the SPC boom the pattern of high growth of Argentina would not be assured from now on.

Public accounts are the second channel through which the improvement in the exporting performance of the SPC affects the macroeconomy. In the crises mentioned previously there were a problem of “external transfer”, in the sense that the economy as a whole was unable to pay its external obligations. There was also a problem of “domestic

transfer”, in the sense that the agent who had the obligation to pay the external debt first had to manage to get the foreign currency from other domestic agents. More specifically we are talking about the government as the debtor and the exportable sector as the provider of foreign currency. The methods applied to transfer the foreign currency involve not only market purchases but also regulations and taxes. That is why the monitoring of the health of the macroeconomy requires an analysis of the fiscal performance.

Figure 11. External sustainability and the SPC sector



Source. CEI

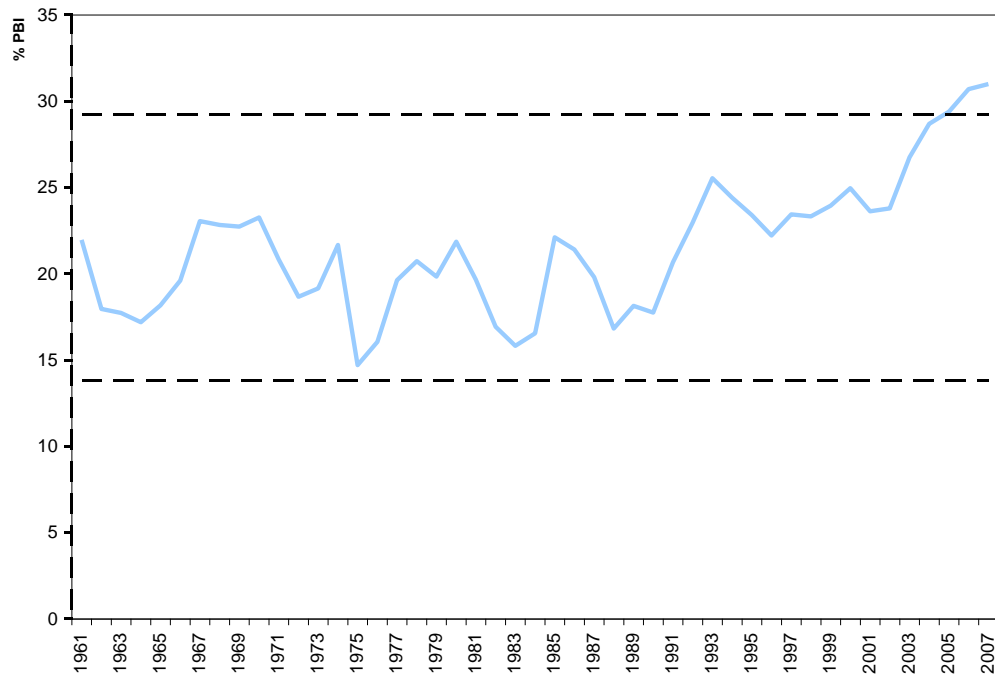
The following panel presents some information of the fiscal performance of the central government. The first interesting issue is that tax collection which has been traditionally lower than that for developed countries has grown substantially in the last years, which is favorable to fiscal sustainability. Additionally the figure (b) shows the evolution of the revenues corresponding to the Dirección General de Aduanas (i.e. Customs). Note there that, since the applications of new taxes on exports, as we explain in section II, the tax collection from the tradable sector as a share of GDP is in the maximum values of the last five decades. In particular, as it is observed in the figure, revenues associated with exports represent currently 2% of GDP, that is, almost 10% of total revenues.

Has it changed the probability of a fiscal crisis to occur? In order to evaluate the fragility of the fiscal account we will follow a methodology similar to the one used for the external accounts. Accordingly, we found an expression for the required surplus (in this case we refer to the primary surplus of the central government) to maintain constant the ratio of net debt (in this case, public) to GDP (dp_t).

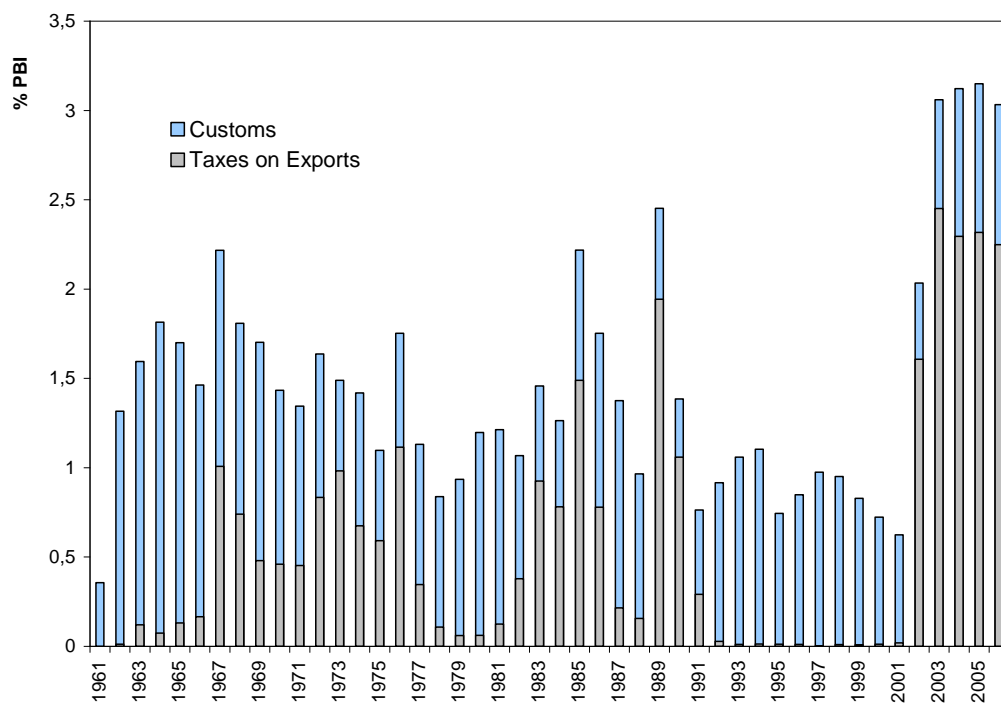
$$\sup^* = \frac{(rp_t - g_t)}{1 + g_t} dp_{t-1} \quad (5)$$

Panel 2. Evolution of the fiscal revenues

(a) Total



(b) Related to External Trade

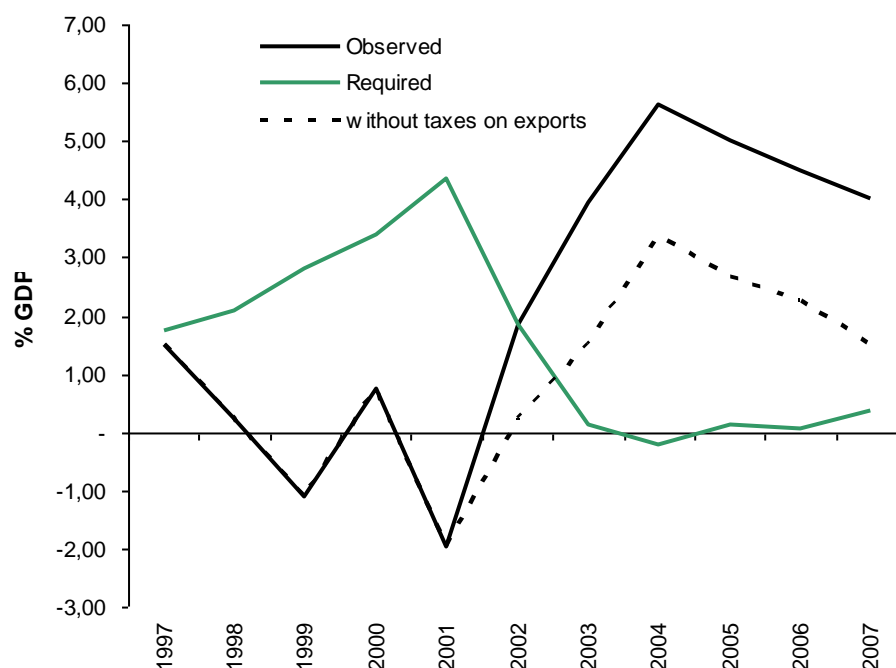


Source: DGI

More precisely, sup^* is defined as the primary surplus that is required to maintain the public debt /GDP ratio in the level that had reached in the previous period (dp_{t-1}) and rp_t is the interest rate average paid by the public sector.

Note in the following figure that in the 1970s and 1980s the situation was very fragile: at no moment the effective primary surplus surpassed the required one. Clearly, the situation was more complicated in the second decade (the eighties), in as much the interest rate on the public debt (mainly external) was extremely high. This situation was followed by a five-year period of low fragility, although already as of 1995, the observed public surplus is located consistently below the required one. That is to say, the ratio of public debt to GDP was systematically increasing in this period. The situation tends to get worse in 1998, although the primary result of the public sector was improving. Clearly, this situation implies that public debt entered in an explosive path. After the crisis the primary surplus of the public sector became strongly positive and it is superior to the necessary one to maintain the debt ratio constant. This evolution of the primary surplus allowed the government to implement the debt pay-off policy, which – together with the debt renegotiation of 2004- explains the sensible fall in the required surplus.

Figure 12. Fiscal Sustainability and the SPC sector



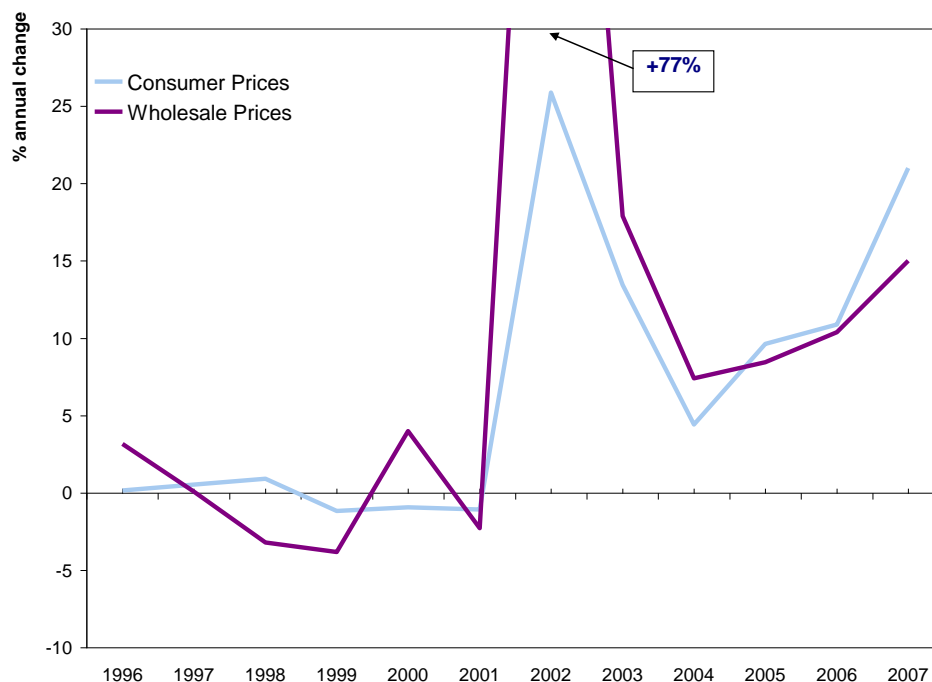
Source: INDEC

Did SPC export dynamics explain these changes in public sector performance? In order to see it, the dotted line shows the theoretical evolution of primary the fiscal surplus if it assumes that the collection due to taxes on exports is null. Note there that - although the

figures are not negative - the fiscal surplus reduced considerably, threatening the fiscal viability of here in more.

The third channel relating SPC performance with macroeconomic conditions is through the inflation. This is damaging because it affects key social indicators, such as poverty. The following figure shows the evolution of wholesale and consumer rates of inflation in Argentina for the period 1996-2007. Note that after the “jump” in the rate of inflation in 2002 produced by the devaluation of the peso, the inflation decelerated, while it accelerated again in 2005. In fact, inflation in consumer prices for 2007 is projected over 20%.

Figure 13. Inflation in Argentina

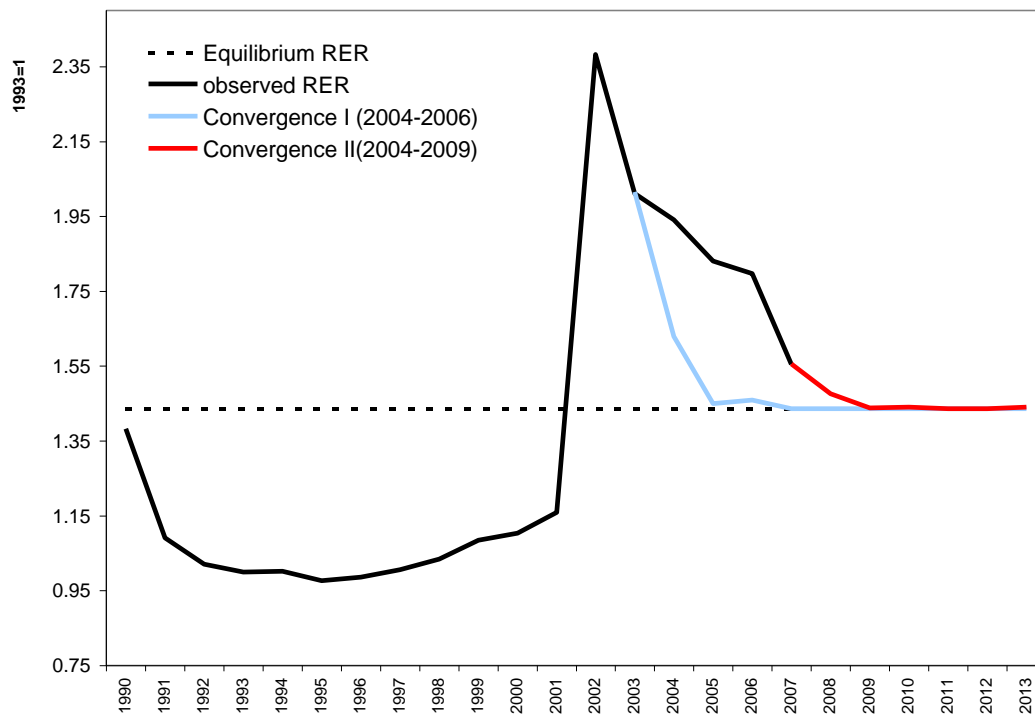


Source: INDEC

Many of the products that contribute to the export basket, which have been inflated its prices in last years, has a preponderant role in the basic consumption basket. It is the case for the meat, the maize and wheat (v. Nogues and Porto, 2007). Nevertheless, it is not the case for the soybean, whose participation in the basic food basket is practically zero. In that sense, making the export base more intensive in SPC products would mainly have an indirect effect on inflation, namely, the provision of international liquidity and the pressure to the exchange rate to depreciate. Since mid-2003 the government had been implementing active policies in foreign exchange markets with the goal of maintaining the real exchange rate at competitive levels. In 2004-2005, several price controls and low pressure for raising wages, due to unemployment, kept inflation at low levels. Thus, central bank interventions (as a buyer) in foreign markets incentive profits in the tradable sector. With a real exchange rate above its equilibrium level the economy avoided the pattern of “overshooting and fast adjustment” that was characteristic in previous situations. By all means, the cost of this policy was not null: The need to buy the excess of supply of foreign currency has as counterpart the rapid

expansion in domestic liquidity, which require active policies as well, regarding the sterilization of the inflationary component of the monetary base. Of course, this policy cannot be permanent. Consequently, the decision of control the nominal exchange rate and by this mean the real exchange rate at competitive level generates repressed inflation, which is just waiting for its time to act and bring the real exchange rate to its equilibrium level.

Figure 14. Real Exchange rates in Argentina



Source: INDEC

Thus, the current rate of inflation that is observed is closely related to the reaction of the monetary authority to the significant surplus in trade balance after the devaluation of the peso. What role has had the SPC performance in these inflation dynamics? In order to answer this we calculate how much it would have been the trade balance surplus if the exporting base had experienced no changes in the last fifteen years. That is, we are trying to control for the SPC boom. The following table sample the evolution of the monetary base (and therefore, of the inflationary pressures) observed in the data and the theoretical monetary base that suppose the nonexistence of the SPC boom. Note there that the liquidity and inflation effects of the SCP boom are not very strong.

Table 4. Central bank interventions and the SPC effects

Year	Central Bank Intervention		Sterilization and others	Monetary Base	
	Observed	Theoretical		Observed	Theoretical
2004	23,168	23,168	-17,715	6,086	6,086
2005	28,227	26,816	-26,417	2,233	822
2006	43,006	40,856	-17,583	25,356	23,206
2007	32,321	30,705	-14,665	18,912	17,296

V. Conclusions

In Argentina, soybean production began in the 1970s. During this decade, the harvest grew from 26 thousand tons in 1970 to 3.7 million in 1979, representing a 9 per cent increase in the area destined to these crops. This period also showed a rise in productivity, from 1 ton per hectare in 1970 to 2.3 in 1979. During this stage production levels of the oilseed industry grew and its capital stock was modernized along with the expansion of the primary sector. Two issues were key in this evolution: (a) the reduction of the restrictions and tariffs on exports of these foods (from 37% of FOB value in 1972 to -2% in 1979) and (b) the design of a differential exchange rate system to stimulate oilseed exports to the detriment of grain sales.

The second expansionary stage of the soybean production chain (SPC) began in the mid-1980s and extended until the mid-1990s. In that period, the primary production increased from 4 million tons to 12 million. The growth pattern was erratic, affected by climatic difficulties and the volatility of international prices. In that context, the increase in the harvest was made possible by duplicating the seeded farmland, whereas the productivity remained practically constant. The soybean continued to gain participation in the farming activity, representing 33% of the total of farmland dedicated to oilseed and cereals in the mid-1990s. At this stage the reconstruction of the related industries deepened with the installation of new high-scale plants, conceived mainly to meet the demands of the external market. Innovations in the crushing technology of grains and oilseed refinement were applied, along with new investments in harbors and logistics. The production of oilseeds grew from 1 million annual tons at the end of the 1970s to 11 million tons in 1996. At the same time, the productivity of the manufacturing branch increased since production growth cannot be explained by the increase in factor utilization.

In sum, in the mid-1990s, SPC showed a primary production of 12 million tons and a level of industrial processing of 11 million tons. In both cases, activities were positioned on the international frontier of competitiveness. The allocation of non-primary related activities, near the farmland, offered the manufacturing branch the advantage of additional competitiveness. Finally, the soybean production chain was characterized by its export profile (US\$ 2,500 million per year), as a result of the reduced domestic consumption of oilseeds and its byproducts and of a bovine activity based on pastures.

Only one decade later, SPC managed to constitute itself in the sector of the whole economy with a better integration with international markets. Between 1996 and 2007, the primary production of oilseeds grew from 12 million tons to 48 million, whereas SPC exports increased from 11 million tons to 46 million (see figure). In that way Argentina was transformed into the leading exporter of oilseeds and soybean flour, together with being the main worldwide pole of oilseed production in the environs of Rosario (province of Santa Fe).

Remarkably, the productive and exporting dynamics of SPC was closely related to a high rate of innovation observed in this period, fundamentally in oilseed sowing. Domestic producers adopted state-of-the-art technologies – associated with

biotechnology – without important lags. The high speed of local assimilation of the global innovations contrasted notoriously with the rest of the primary activities and the manufacturing sector. Therefore, the study of the pattern of growth and innovation in SPC becomes essential in trying to understand this dualism. More specifically, it is necessary to identify the factors that impelled their development and draw lesson for the rest of the economy so as to transmit the high-innovation pattern to the whole productive sector.

The above pattern of innovation and growth was the result of (the aggregation of) microeconomic decisions taken by individual agents. Of course, these decisions were not unbounded. There were macroeconomic factors, such as international prices, domestic regulations and exchange rate/monetary regimes, that motivate or discourage particular decisions. It is not a one-way relationship because individual decisions in SPC impose constraints on institutions' performance and macroeconomic behavior in many ways, for example, by fueling distributive conflict in the first case or by affecting fiscal and external gaps.

In this paper we study the innovative performance of SPC focusing on these micro-macro interactions. More specifically, we study the impact of diverse institutional factors (deregulation of the primary activity and changes in the tariffs on exports), international factors (the evolution of the price and size of the soybean market and its derivatives) and macroeconomic factors (aggregate volatility, regime changes, and financial development) on the innovating dynamics of SPC in the last decade. We then analyze the impact of these decisions on the macroeconomic and institutional performance, discussing the effects on the balance of payments on the fiscal accounts and on distributive conflict.

Our results can be summarized as follows. First, structural reforms regarding trade liberalization had a tremendous impact in the SPC sector. Second, with the return of active trade policies in the 2000s, the tax structure implemented was – and still is – highly beneficial. Third, international prices in the 2000s are very favorable to the SPC sector with its obvious positive effect on profits. Fourth, at any rate SPC faced the challenge of higher profits in a context of volatile prices by innovating and raising productivity. Fifth, the SPC recent performance has positive effects on the external and fiscal accounts.

References

- Albrieu, R. (2008), “Fluctuaciones agregadas como “episodios macroeconómicos”. El caso de Argentina 1875-2007”. Mimeo, MECON-CEDES.
- Albrieu, R., Bernat, G. y E. Corso (2006), “Dinámica de Precios y Cantidades postdevaluación. Un Estudio de Redistribución de Flujos”. Documento de Trabajo CEDES N° 28.
- Asociación Argentina de Consorcios Regionales de Experimentación Agrícola – AACREA (2005): “Agroalimentos Argentinos II”.
- Bisang, R. (2007), “El desarrollo agropecuario en las últimas décadas: ¿volver a creer?”, in “Crisis, recuperación y nuevos dilemas. La economía argentina 2002-2007”, B. Kosacoff (ed.), Oficina de la CEPAL-ONU, Buenos Aires, Argentina.
- Bisang, R. (2001), “Apertura económica, innovación y estructura productiva: La aplicación de biotecnología en la producción agrícola pampeana argentina”, Idel, Universidad Nacional de General Sarmiento, Buenos Aires, Argentina.
- Bisang, R. (2007), “comentario a Albrieu y Corso”. 1° Foro del bicentenario, Buenos Aires.
- Centro de Estudios para la Producción - CEP (1999), “Reporte Industrial 1999”, Ministerio de Economía de la República Argentina.
- Cerro, A, Amado, N. y O. Meloni (2006), “Making Explosive Cocktails: recipes and costs for 26 crises from 1823 to 2003”: Trabajo presentado en: XL Reunión Anual, Asociación Argentina de Economía Política, Universidad Nacional de La Plata (Nov 2005).
- Chisari, O.; Fanelli, J; Romero, C. y E. Corso (2007), “Growth Diagnosis for Argentina”. Mimeo, CEDES/BID.
- Corso, E. y Fanelli, J.M. (2006), “El Nuevo regimen cambiario en la Argentina y sus implicancias para el Mercosur” in Berlinski, J., F Pires de Souza, D. Chudnovsky, and Andrés Lopez (Eds), 15 años de MERCOSUR, Red MERCOSUR, Montevideo.
- Diaz Alejandro, C. (1970), Essays on the Economic History of the Argentine Republic.
- Fanelli, J. y R. Frenkel (1994), “Estabilidad y estructura: interacciones en el crecimiento económico”, mimeo, CEDES.
- Fanelli, J. and R. Frenkel (2000) “Micro-Macro Interactions, Competitiveness and Sustainability”, Mimeo, CEDES.
- Fanelli, J.M. (2008), Macroeconomic Volatility, Institutions and Financial Architectures, London, Palgrave Macmillan.
- Gutman, G. and P. Lavarello (2003): “La trama de oleaginosas en Argentina”, Estudio 1.EG.33.7, Componente B -3, Oficina de la CEPAL-ONU, Buenos Aires, Argentina.

- Hausmann, R.; Rodrik, D. and Velasco, A. (2005), "Growth Diagnostics." Cambridge, MA: The John F. Kennedy School of Government, Harvard University, March.
- Katz J. (1986), Desarrollo y crisis de la capacidad tecnológica latinoamericana: el caso de la industria metalmecánica, Buenos Aires, Comisión Económica para América Latina y el Caribe (CEPAL).
- Katz, J. (1996), Estabilización macroeconómica, reforma estructural y comportamiento industrial; estructura y funcionamiento del sector manufacturero latinoamericano en los años 90, Buenos Aires, Alianza Editorial.
- Katz, J. (2007), "Cambios Estructurales y Ciclos de Destrucción y Creación de Capacidades Productivas y Tecnológicas en América Latina". Mimeo.
- Kosacoff, B. (2008), "Development of technological capabilities in an extremely volatile economy. The industrial sector in Argentina". Estudios y Perspectiva N° 40, ECLAC Office Buenos Aires.
- Lane, P. y G. M. Milesi-Ferretti, (2006), "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004," The Institute for International Integration Studies Discussion Paper Series iisdsp126, IIS.
- Llach, Juan; Harriague, Marcela y O'Connor, Ernesto (2004) "La generación de empleo en las cadenas agroindustriales", documento de la Fundación Producir conservando, Buenos Aires.
- Mendoza, E. G and Oviedo, P.M. (2004), "Public Debt, Fiscal Solvency and Macroeconomic Uncertainty in Latin America: The Cases of Brazil, Colombia, Costa Rica and Mexico", NBER, Working Paper 10637.
- Obschatko, E. (1997), "Articulación productiva a partir de los recursos naturales. El caso del complejo oleaginoso argentino", Documento de Trabajo N° 74, Oficina de la CEPAL-ONU, Buenos Aires, Argentina.
- Obschatko, E. y M. Piñeiro (1986), "Agricultura Pampeana: Cambio tecnológico y sector privado". Ed. CISEA.
- Rodríguez, J. (2005), "Los complejos agroalimentarios y el empleo. Una controversia teórica y empírica". Documento CENDA N°3.
- Teubal, M. y Giarraca (2004) El campo argentino en la encrucijada. Estrategias y resistencias sociales, ecos en la ciudad. Alianza Editorial.